Docket No. AUS920010408US1

CALLER-INITIATED TRANSFER OF SERVICES BETWEEN TELEPHONES

BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention is directed generally toward administering a mobile telephone service. More specifically, the present invention is directed toward transferring services between mobile telephones

2. Description of Related Art:

The mobile telephone has ushered in a new era in interpersonal communications. While the late 1990s' widespread consumer interest in the Internet made ours a wired world, technical advances and increased consumer appeal are ushering in a new "wireless world." A number of mobile telephone manufacturers and service providers cater to a growing base of mobile telephone subscribers. Unlike most local telephone service in the United States, but akin to long-distance service, mobile telephone service is usually billed in minutes of airtime. That is, the amount a customer is charged is proportional to the amount of time spent in mobile telephone calls. For instance, a five minute call will usually cost five times as much as a one minute call. Unlike with long-distance service, however, airtime is generally billed to the customer regardless of whether the customer placed or received the call.

Because having every minute of every call charged for is a major discouragement to consumers wishing to use mobile telephones, mobile service providers generally employ a billing system in which customers pre-pay for a certain

number of minutes of airtime each month. When a customer makes a call, the minutes of airtime are subtracted from the customer's balance of minutes for the month. Any additional minutes exceeding the customer's pre-paid balance are billed for separately. In most billing schemes, the current month's minutes expire at the end of the month if not used.

Thus, many mobile telephone customers pay for their telephone usage by redeeming pre-paid credits (measured in minutes of airtime). This scheme has many analogs in other areas of business. For instance, most individuals will mail a letter by first buying a pre-paid postage credit (i.e., a postage stamp), then redeeming the credit (i.e., mailing the letter with the stamp attached). Unlike postage stamps, currency, or other valuable units of exchange, under current mobile telephone billing systems, airtime minutes may not be transferred between customers. From an economic perspective, this can result in an inefficient use of resources. For instance, if a mobile telephone customer pays for 100 minutes of airtime as a part of the normal subscription plan, but the customer, for whatever reason, does not need that many minutes in a given month, the minutes (and the customer's money) will be wasted since the customer does not have a way to transfer those pre-paid minutes to someone who can use them before they expire.

Thus, there exists a need for an ability to transfer minutes from one customer's telephone account to another.

SUMMARY OF THE INVENTION

The present invention provides a method, computer program product, and data processing system for transferring mobile telephone minutes or other mobile telephone services or features from one customer to another. A customer dials into an interactive service that allows the customer to specify one or more recipients and a number of minutes, services, or features to transfer. A data processing system associated with the customer's mobile telephone service provider effects a transfer of minutes, services, or features from the customer's account to the recipients' accounts. In addition, a notification that the transfer has occurred can be sent to the recipients.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

Figure 1A is a diagram of a mobile telephone with which the processes of the present invention may be implemented;

Figure 1B is a block diagram of a mobile telephone with which the processes of the present invention may be implemented;

Figure 2 is a diagram of the operation of a mobile telephone system in which the present invention may be implemented;

Figure 3 is a block diagram of a data processing system in which the processes of the present invention may be executed;

Figure 4 is a diagram of a database holding information about mobile telephone subscribers in a preferred embodiment of the present invention;

Figure 5 is a diagram of a process of transferring mobile airtime minutes in accordance with a preferred embodiment of the present invention;

Figure 6 is a flowchart representation of a process of transferring services between telephone customer accounts in accordance with a preferred embodiment of the present invention; and

Figure 7 depicts a telephone-PDA combination utilizing a menu-based interface as used in a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 depicts an exemplary mobile telephone **100** with which the processes of the present invention can be implemented. Mobile telephone **100**, for instance, could be a Talkabout® T8167 Mobile Telephone from Motorola, Inc. of Schaumberg, Ill. Like a conventional telephone, mobile telephone **100** contains an earpiece **102**, a microphone **104**, and a keypad **106** for emitting DTMF (Dual-Tone Multiple Frequency) tones for dialing. Mobile telephone **100**, unlike a conventional telephone, uses an antenna **108** as its communications link to the Public Switched Telephone Network (PSTN), the standard public telephone network through which most telephone calls are routed. Mobile telephone **100** may transmit and receive data, including but not limited to voice data, through an analog-coded or digitally coded signal. One common communications standard for mobile telephones is the PCS (Personal Communications Services) standard, which uses digital signal coding. Some mobile telephones, such as dual-band mobile telephones, will allow multiple communications standards to be used with the same telephone; this is a convenience, particularly in remote areas where some communications protocols are not available.

Mobile telephone **100** includes a "send" button **110** and an "end" **112** button for initiating and terminating calls, respectively. To dial another telephone, a user enters the telephone number for that telephone on keypad **106** and presses "send" button **110** to place the call. To "hang up" or terminate the call, the user presses "end" button

112.

Mobile telephone **100** also includes a liquid-crystal diode (LCD) display **114** for indicating to a user the status of mobile telephone **100**, such as when mobile telephone **100** is dialing. In some mobile telephones, display **114** may be used for executing software, such as games, or for browsing World Wide Web documents loaded from the Internet through a wireless connection using antenna **108**. A user of mobile telephone **100** will generally rely on a service provider to provide a wireless gateway into the PSTN. In addition to allowing a user to send and receive telephone calls, a service provider may provide additional features to customers. One of these features, as was already mentioned, is wireless Internet access. Another is voice mail. If the user of the mobile telephone **100** is unavailable (i.e., has turned off mobile telephone **100**, is already talking to someone using mobile telephone **100**, or simply ignores the ringing mobile telephone **100**), a caller calling mobile telephone **100** can be switched into a voice mail service, where the caller can leave a message for the user of mobile telephone **100**. An indicator, such as an envelope icon, can appear in display **114**. The user of mobile telephone **100** can later access the voice mail service by pressing a special voice-mail button **116** or by calling a special telephone number (such as *123, for instance) or by calling the user's own number. The user can then use keypad **106** to enter DTMF tones to select recited voice mail menu options.

Mobile telephone **100** will generally run on some kind of battery power using a rechargeable battery pack, or the

like. To conserve energy when mobile telephone **100** is not needed, power button **118** may be used to turn off and later turn on mobile telephone **100**. When mobile telephone **100** is turned off, it cannot send or receive calls, although voice mail services are still available. **Figure 1B** is a block diagram of mobile telephone **100**. Bus **120** provides the central backbone through which the electronic components of mobile telephone **100** communicate.

Attached to bus **120** is a communications circuitry module **122**, which transmits and receives mobile telephone signals through antenna **124** using one of a number of transmission and multiplexing schemes available for wireless communications including, but not limited to, FDMA (frequency division multiple access), TDMA (time division multiple access), CDMA (code division multiple access), and GSM (global system for mobile communications).

Communications circuitry module **122** and other components of mobile telephone **100** are controlled by processor **126** which may be a general-purpose microprocessor, such as a PowerPC microprocessor, or a digital signal processor or other specialized processor. Processor **126** executes program code stored in memory **128** to direct the operation of mobile telephone **100**. Processor **126** also uses memory **128** to store data, such as frequently-dialed telephone numbers.

A variety of input-output (I/O) components communicate with processor **126** through bus **120**, including keypad **130** and liquid-crystal display (LCD) **132**. Analog-to-digital converter **134** takes analog audio information from

microphone **136** and converts it to a digital data representation for transmission over bus **120**. Likewise digital-to-analog converter **138** takes digital data from bus **120** and converts it into audio for presentation through earpiece speaker element **140**.

All of these I/O components communicate with and are coordinated by processor **126**. For example, digital audio data created by analog-to-digital converter **134** is retrieved by processor **126**, prepared for transmission by processor **126**, and then sent to communications circuitry module **122** for transmission over antenna **124**. To take another example, a telephone number entered by a user using keypad **130** is retrieved by processor **126**, which generates DTMF tones for transmission by communications circuitry module **122**. Processor **126** then displays the entered telephone number on LCD display **132** to the user.

Figure 2 is a diagram depicting the operation of a mobile telephone **202** within a telephone system **200**. Mobile telephone **202** communicates with radio tower **204**, sending and receiving voice and other data, such as Internet data. Service provider facility **206** connects control tower **204** with Public Switched Telephone Network (PSTN) **208**. Service provider facility **206** also performs such tasks as recording the number of minutes mobile telephone **202** stays connected on a call and providing voice mail and Internet services.

PSTN **208** connects service provider facility **206** with other communications devices such as telephones **210** and **212** and (by way of a service provider and radio tower) mobile telephone **214**. One of ordinary skill in the art will recognize that many communications devices that are

not telephones may be connected to PSTN **208** and thus accessible by mobile telephone **202.**

One of ordinary skill in the art will also recognize that multiple service providers may be present within the same geographic area. In the diagram, service provider facility **209** represents an additional service provider in competition with the operators of service provider facility **206.**

Figure 3 is a block diagram of a data processing system **300** in which the processes and computer program product instructions of a preferred embodiment of the present invention may be implemented. Preferably data processing system **300** will be associated with equipment operated by a mobile telephone service provider. For example, data processing system **300** may be associated or located in service provider facility **206** in **Figure 2.**

Data processing system **300** includes a (central) processing unit **302** connected to a local bus **304.** Processing unit **302** executes instructions stored in memory **306,** which is also connected to local bus **304.** Processing unit **302** may comprise a single processor, such a microprocessor, or it may comprise multiple processors so as to allow the execution of multiple instructions simultaneously. Any number of processors could be used in processing unit **302.** An example of a suitable processor is the PowerPC microprocessor, developed by IBM Corporation of Armonk, New York.

Many different types of memory are available and suitable for use within data processing system **300.** Memory is generally classified as volatile and non-volatile memory. Volatile memory types store data temporarily while the

data processing system is operating, but lose their data once the data processing system's power is turned off. Most volatile memory in use today is "random access memory," (RAM) meaning that data and instructions may be read from or written to any portion of the memory at any time. Common random access memory types well-known to those skilled in the art include static random access memory (SRAM) and dynamic random access memory (DRAM). Non-volatile memory types retain their information, even when the data processing system is turned off. Non-volatile memory types are generally referred to as "read-only memories" (ROM). Many types of non-volatile memories exist. Programmable read-only memory (PROM) may be programmed with permanent data using a PROM programming device. Erasable programmable read-only memory (EPROM) can be erased of its data contents, through such means as ultraviolet radiation or through electric current (as with an electrically-erasable PROM or EEPROM). Flash memory and non-volatile random-access memory (NVRAM) are two memory media that may be written to and erased within working circuits without the use of a memory programming device.

Memory **306** may store data to be operated upon by processing unit **302**, it may store instructions to be executed by processing unit **302**, or it may store both. In **Figure 3**, a single memory module is depicted, although many memory arrangements are possible. Cache memory, which is a high speed memory used for temporary storage of data and instructions to be stored to read from a primary bank of memory may be used. Also, certain systems designed with what is known as a "Harvard architecture" use separate memory and buses for data and

instructions.

PCI bus bridge **308** connects local bus **304** to PCI input/output (I/O) bus **310**. PCI I/O bus **310** is what is known as a backplane bus. A backplane bus is not connected directly to a central processing unit, but communicates with the central processing unit via a bus bridge. Peripheral devices, such as disk drives and other input/output and storage devices typically connect to backplane buses. Having a separate backplane bus prevents peripheral device malfunctions from interrupting the operation of the central processing unit (processing unit **302**).

Secondary storage **312** is connected to PCI I/O bus **310**. Secondary storage **312** may comprise one or more disk drives, magnetic tape drives, optical storage devices, or other persistent storage medium. Secondary storage **312** preferably stores relatively large amounts of data and instructions compared to memory **306**. Secondary storage **312** may be used for permanent storage of data or instructions, such as a database, or secondary storage **312** may be used to supplement memory **306** with additional storage space. One common method of providing additional storage space to augment memory **306**, called virtual memory, involves swapping portions of data, called pages, between memory **306** and secondary storage **312** such that pages are addressed and located in memory **306** when in use, but swapped out to secondary storage **312** when not in use.

Also connected to PCI I/O bus **310** is a telephone interface device **314**. Telephone interface device **314** includes a PCI I/O adapter **316** connected to PCI I/O bus

310. PCI I/O adapter **316** allows telephone interface device **314** to communicate through PCI I/O bus **310.** PCI I/O adapter **316** is connected to telephone interface system bus **318,** which connects the various components of telephone interface device **314.** An embedded processor **320** is preferably some sort of microprocessor, such as a Z80 microprocessor, manufactured by Zilog, Inc. Embedded processor **320** executes instructions stored in memory **322,** which is also attached to telephone interface system bus **318.** Embedded processor **320** interprets commands communicated through PCI I/O adapter **316** and, in response, directs the operation of telephone interface device **314.** Embedded processor **320** operates on data, which it stores and retrieves in memory **322.** Alternatively, a microcontroller, such as an 8051 microcontroller, manufactured by Intel Corporation, could be used in place of embedded processor **320** and memory **322.** A microcontroller is a monolithic integrated circuit containing both a processor unit and memory. Dual Tone Multiple Frequency (DTMF) decoder **324** interprets DTMF tones from telephone network line **326,** translating the tones into corresponding numbers from a telephone keypad. DTMF decoders are available as monolithic integrated circuits from a number of vendors. DTMF decoder **324** reports the numeric interpretation of the DTMF tones to embedded processor **320** through telephone interface system bus **318.**

Telephone network line **326** can be connected directly into the Public Switched Telephone Network, perhaps using a DSL (Digital Subscriber Line) modem. It may also be connected through a local-area network (LAN) using, for

example, an RJ45 modular connector for an Ethernet LAN, perhaps connected to a T1 line (a high-bandwidth network line). Although a standard analog telephone line may be used, a more likely option would be utilize a digital telephone line instead.

Telephone line control system **329** acts under the control of embedded processor **320** to "pick up" or "hang up" telephone network line **326**. Telephone line control system **329** also detects when telephone network line **326** is "ringing."

Embedded processor **320** transmits audio messages across telephone network line **326** by transmitting digital audio data (which may include voice, indicator chimes, DTMF signals, or any other audio signal) from memory **322** through communication module **330**.

Figure 4 is a diagram depicting the format of an account information database stored within secondary storage **312** of **Figure 3** in a preferred embodiment of the present invention. Table **400** includes entries **402** for each of the customers of a mobile telephone service provider. Account holder field **404** stores the name or identity of each customer. Account number field **406** stores an account number for each customer, which may be the customer's telephone number. Minute balance field **408** stores each customer's balance of remaining call minutes.

The present invention provides a method, computer program product, and apparatus for transferring call minutes or other services from one customer's account to another. In a preferred embodiment, for instance, the customer whose entry is **410** can transfer call minutes from his balance of minutes to another customer, the customer

whose entry is **412**, for instance. The data processing system maintaining table **400** can effect the transfer by subtracting the number of transferred minutes from entry **410** and adding the minutes to entry **412**.

Also, in a preferred embodiment, the mobile telephone customer whose entry is **410** may transfer minutes to another mobile telephone customer who is using a different telephone service provider (**414**) and whose entry is **416**.

Figure 5 provides a story board representation of a process of transferring call minutes from one customer's account to another's in a preferred embodiment of the present invention. In step **502**, the customer transferring the minutes dials an telephone number or access code (such as *123) for the transfer function on keypad **504**. Then the customer presses "Send" button **506** to initiate a call to the service. A call is connected to data processing system **300**, as described in **Figure 3**. In step **508**, data processing system **300** answers the call and plays a recorded message through digital to analog converter **330**, asking for the recipient's telephone number.

In step **510**, the customer enters the recipient's telephone number and the "#" (pound) key on keypad **504**, which causes DTMF tones to be produced and transmitted to data processing system **300**. Data processing system **300** then decodes the DTMF tones to recover the entered digits. Next, in step **512**, the customer is prompted to enter the number of minutes to transfer and press the "#" key. In step **514**, the customer enters the number of minutes on keypad **504** and presses "#" key **516**. In step

518, a response, reciting the number of minutes transferred is played. Finally, in step **520**, the customer presses "End" key **522** to terminate the call.

Figure 6 is a flowchart representation of a process for transferring minutes between customer accounts in a preferred embodiment of the present invention. First, a call to mobile phone service provider equipment is received (step **600**). The recipient's telephone number is received (step **602**). Then the number of minutes to be transferred is received (step **604**). Customer records are updated to reflect the transfer of minutes between the accounts (step **606**). Finally, the call is terminated (step **608**).

One of ordinary skill in the art will recognize that a number of variations of the present invention exist. For instance, one particularly useful feature that could be added to the embodiment herein described would be a notification to the recipient that the recipient has received a certain number of minutes. The notification may be as simple as a pre-recorded message from the service provider sent via voice mail or as a courtesy call to the recipient. It may be a text message transmitted and displayed on display **114** (**Figure 1**) or sent via electronic mail for example. Another possible option would be to allow the customer making the transfer to leave a voice mail message at the time of transfer. This would be particularly useful when the minutes transfer was a gift for a special occasion, for instance; the transferring customer could leave some kind of voice mail greeting wishing the recipient a happy birthday or some other gesture of goodwill.

Another variation, tied to the notification process would

be to allow a recipient to accept or reject transfers. The recipient could respond to a text or voice mail notification by making a call to data processing system **300**, for example, and selecting, through a series of prompts and responses, whether to accept or reject the transfer.

Yet another possible variation is to set up a periodic donation, where either a certain sum of minutes or, for instance, a customer's remaining balance of minutes at the end of a month are transferred to another recipient each month, or on some other periodic basis. This would particularly useful if a customer has remaining minutes at the end of a month that will expire; the customer could be allowed to preserve those minutes for someone else by giving them away.

Features or services other than call minutes could be transferred as well. For instance, if a customer has paid for enhanced telephone features the customer could transfer that service or feature to another customer for a certain period of time. For example, one customer could, as a gift, transfer a call-forwarding feature (allowing a customer to have all her calls forwarded to another telephone number) to another customer for a month.

Transfers of services need not be to only a single recipient. A transferring customer could name multiple recipients to receive the same service, feature, or number of minutes. As a convenience, a customer could be allowed to set up a distribution list, so that transfers made to the distribution list are shared among the member customers of the distribution list.

The transfer service need not be free of charge. Mobile

telephone service providers could charge a transaction fee for performing a transfer. They could also offer the ability to make (free or for fee) transfers as a premium telephone service.

Another possible variation on the present invention is to allow transfers between customers having different mobile telephone service providers. Service providers enter into reciprocal agreements to allow transfers to and from different service providers. Service providers agree to exchange rates, wherein certain services or features from one service provider would have a relative value vis-à-vis services or features from another service provider. For example, two service providers (A and B) may agree to allow transfers of minutes between the two service providers with an exchange rate of 3 minutes of A for every 2 minutes of B. Accordingly, a customer of B could transfer 100 minutes of his calling time to a customer of A. The customer of A would receive 150 minutes of calling time, due to the exchange rate agreement between A and B.

From a technical standpoint, transfers between service providers could be facilitated by having the data processing systems of one service provider connected in a network, such as the Internet or the PSTN, along with the data processing systems of the other service provider. Transfers from one service provider to another would then involve transmitting an instruction across the network from one service provider to another service provider to update customer account records.

Although the preferred embodiment involves mobile telephone accounts, the present invention is not strictly limited to use with mobile telephones. Another variation

on the present invention is to allow transfer of services between non-mobile telephone service provider accounts. For instance, a user of a pre-paid calling card transfers minutes from her calling card account to that of another customer. Likewise, a user of conventional telephone service transfers a service, such as call waiting (where a customer that is on the phone can still receive calls from others), or local or long-distance minutes to another customer.

The invention is not limited to use with traditional telephones or mobile telephones, either. New hybrid devices, such as telephone-PDA (personal digital assistant) combinations are becoming more prevalent. These devices could be used in the present invention, as well.

The present invention is also not limited to an audio or touchtone interface. Speech recognition technology is available that would make it possible for a user to speak his or her selections, rather than entering them using a touch-tone keypad.

Visual interfaces using the LCD screen of a telephone or telephone-PDA combination could also be used for entering user selections. For instance, a user could select a number of minutes to transfer from a menu of choices (e.g., 15 minutes, 30 minutes, 45 minutes, etc.) on the LCD of the user's telephone-PDA.

Figure 7 depicts a telephone-PDA combination **800** utilizing a menu-based interface. Telephone-PDA combination **700** uses antenna **702** to transmit and receive audio and other data. A receiver microphone and earpiece are not shown as they are located on the reverse side of telephone-PDA combination **700**.

Touch-sensitive screen **704** displays menu options **705** that are available to the user. The user may choose an option by touching the desired one of options **705** with stylus **706.** In an alternative embodiment, the particular service or amount of minutes to be transferred could be entered by "writing" the appropriate service or amount of minutes on writing interface surface **708** using stylus **706.**

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media, such as a floppy disk, a hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and transmission-type media, such as digital and analog communications links, wired or wireless communications links using transmission forms, such as, for example, radio frequency and light wave transmissions. The computer readable media may take the form of coded formats that are decoded for actual use in a particular data processing system.

The description of the present invention has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in

order to best explain the principles of the invention, the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.